C1 cmt. having a second upper surface, wherein an upper surface of the conductive structures 255 are substantially-planar with the second upper surface of the dielectric layer 230.

In the Claims

Please amend the claims as follows; a marked-up version of the amendments is attached hereto as an Appendix:

C2 37. The device of claim 36, wherein a portion of the dielectric layer including the second upper surface has a side wall portion that is substantially aligned with a first side wall portion of the second metal layer, and wherein the portion of the plug including the second upper surface has a side wall portion that is substantially aligned with a second side wall portion of the second metal layer.

Remarks

Favorable reconsideration of this application is requested in view of the following remarks. For the reasons set forth below, Applicant respectfully submits that the claimed invention is allowable over the cited references.

The Office Action dated February 27, 2002 indicated that the drawings stand objected to; the title is not descriptive; claims 28-32 and 34 stand rejected under 35 U.S.C. §112, first paragraph; claims 28-30, 34 and 36 stand rejected under 35 U.S.C. §112, second paragraph; and claims 27-37 stand rejected under 35 U.S.C. §103(a) as being unpatentable over *Korman* (U.S. Patent No. 5,959,357) in view of *Green et al.* (U.S. Patent No. 4,851,895).

Claim 37 has been amended to correct an informality.

Applicant respectfully submits that the drawing features recited as allegedly missing in the Office Action are shown, in the originally-filed drawings and/or as amended. For instance, referring to FIG. 2D and corresponding discussion on page 12, lines 4-14 of the Specification, a conductive structure (plug) 255 is shown having first and second upper surfaces and connects first and second metal portions 210 and 250. Furthermore, as one skilled in the art would recognize, the antireflective coating layer 250 may be removed wherein a metal portion, such as an interconnect or a contact, is formed in its place. Referring to FIGs. 2A-2D, a device layer 230

that may include a dielectric material is shown having an upper surface and, as the proposed drawing correction to FIG. 2D shows, may include a second upper surface at portion 236.

Applicant has amended the title as requested by the Examiner. Applicant submits that the amended title is descriptive.

Applicant respectfully traverses the Section 112, first paragraph rejections because the Specification describes the claimed subject matter in such a manner that one skilled in the art would be able to make and use the invention. Regarding the limitations in claims 28-32 and 34, applicant submits that the examples discussed in connection with FIGs. 2A-2D show a plug 255 having attributes to which the claim limitations are directed. For example, when the dielectric material 230 is not polished using CMP, it does not exhibit properties that would exist, had it been polished. Such characteristics of polished surfaces (*e.g.*, grain boundaries and surface conditions) are well known in the art. Similarly, the plug 255 does not exhibit limitations including: an interface formed when a first portion of a plug is planarized before a remaining portion; an interface formed when a first portion of the plug is subjected to CMP; an interface formed when a first portion of the plug is etched before forming a remaining plug portion; or grain boundaries that are formed at an internal interface between two plug portions formed by a separate process. Moreover, various portions of the specification discuss benefits of avoiding such attributes. For instance, page 3, lines 13-16 discusses difficulties with etching aluminum. Similarly, page 1, line 27 through page 2, line 1 discusses the need to planarize (*e.g.*, via CMP) or etch back excess metal, with grain boundaries inherently between firstly and secondly formed layers. In addition, the plug 255 would exhibit properties of an aluminum plug formed using a continuous deposition process in a single step when deposited aluminum is used for the plug, as described on page 10 lines 25-28 of the Specification. In view of the above, Applicant requests that the Section 112, first paragraph rejections be removed.

Applicant respectfully traverses the Section 112, second paragraph rejections of claims 28-30 because the "essential structural cooperative relationships" to which the Office Action refers are limitations that are not present in the claims. Specifically, the claims include negative limitations. Therefore, the cooperative relationships are not required for the claimed subject matter, and Applicant requests that the Section 112, second paragraph rejections be removed.

Applicant submits that the apparent rejection of claim 36 on page 4 of the Office Action is confusing because the indicated phrase is not on line one of claim 36. An amendment to similar language in claim 37 has been made, however. Applicant requests clarification and an opportunity to respond thereto.

Applicant respectfully traverses the Section 103(a) rejection because the Office Action failed to establish a *prima facie* case of obviousness. As indicated in the M.P.E.P., a Section 103(a) rejection requires that the cited references teach or suggest all of the limitations of the rejected claims and that there be motivation for modifying the primary '357 reference to arrive at the presently-claimed invention. In the present instance, Applicant submits that the cited portions of the references fail to teach or suggest every element of the claimed invention. For instance, the "single layer plug 42b" asserted in the Office Action appears to be a two-layer plug. Specifically, Applicant submits that a lower portion of the "single layer plug 42b" below surface 42c would apparently have to be formed prior to an upper portion thereof that is above the surface 42c because the upper portion of the plug is tapered at surface 42c. As column 5, lines 36-39 and FIG. 3 of the '357 reference indicate, the portion "single layer plug 42b" is in fact comprised of separate vias 46. Moreover, the Office Action does not asset, nor does it appear, that the first upper surface 42c is substantially planar to an upper surface of the dielectric layer 44. In view of the above, the Office Action has failed to assert a reference or references that teach or suggest all of the limitations of independent claim 27. Furthermore, because the remaining rejected claims depend from claim 27, these dependent claims also include limitations for which the Office Action has failed to provide a reference showing teaching or suggestion thereof. However, Applicant submits that the Office Action's assertion that the "single layer plug 42b" is a single layer is misplaced when in fact, the "single layer plug 42b" includes multiple vias 46, as discussed above and as acknowledged on page 6 of the Office Action. Therefore, the "single layer plug 42b" would include an interface between multiple vias, and the Office Action's rationale on page 6 that the device of the '357 reference does not exhibit any type of interface is unsupported. Therefore, the Office Action failed to establish a *prima facie* case of obviousness and Applicant requests that the Section 103(a) rejection be removed.

Applicant further traverses the Section 103(a) rejections because the Office Action failed to cite evidence of motivation for modifying the '357 reference to replace the copper with

aluminum. As the Office action acknowledges, the '357 reference does not teach or suggest that an aluminum alloy can be used to make the single layer plug. In a hindsight attempt to modify the '357 reference to replace the copper with aluminum, the Office Action fails to cite any evidence in the prior art in support thereof. Furthermore, Applicant submits that the purpose of the '357 reference, which includes the use of copper, would be undermined. Relevant case law indicates that, without such evidence and where the purpose of the primary '357 reference would be undermined, there is no motivation to modify the '357 reference. Therefore, Applicant submits that the Section 103(a) rejection is improper and requests that it be removed.

In regard to the Office Action's assertion that various ones of the claimed limitations are directed to "product by process," Applicant respectfully traverses because the claimed limitations of the instant application are directed to characteristics of the plug, for example, such as surface characteristics. Therefore, Applicant submits that any "product by process" discussion is not relevant and requests clarification.

In view of the above, Applicant submits that each of the claims is in condition for allowance. Reconsideration and withdrawal of the rejections, along with a favorable response, are earnestly requested.

Should there be any remaining issues that could be readily addressed over the telephone, the Examiner is encouraged to contact the undersigned at 651/686-6633.

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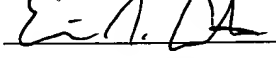
By: 
Name: Eric J. Curtin
Reg. No. 47,511

APPENDIX OF MARKED-UP AMENDMENTS

U.S. Patent Application Serial No. 09/775,370

In the Specification

Please amend the specification as follows:

On page 1, line 1, amend the title as follows:

[OPTIMIZED METAL ETCH PROCESS TO ENABLE THE USE OF] SEMICONDUCTOR DEVICE COMPRISING ALUMINUM-BASED PLUGS

On page 14, line 7, amend the paragraph as follows:

Referring to FIG. 2D, according to one embodiment of the present invention, to prevent recess formation in the non-overlapping portions of the via structures during the over etch process of the aluminum alloy metal lines, an example process 400 as outlined in FIG. 3 may be followed. In one particular implementation, the dielectric layer 230 includes a portion 236 having a second upper surface, wherein an upper surface of the conductive structures 255 are substantially-planar with the second upper surface of the dielectric layer 230.

In the Claims:

Please amend the claims as follows:

37. *(Amended)* The device of claim 36, wherein [the] a portion of the dielectric layer including the second upper surface has a side wall portion that is substantially aligned with a first side wall portion of the second metal layer, and wherein the portion of the plug including the second upper surface has a side wall portion that is substantially aligned with a second side wall portion of the second metal layer.

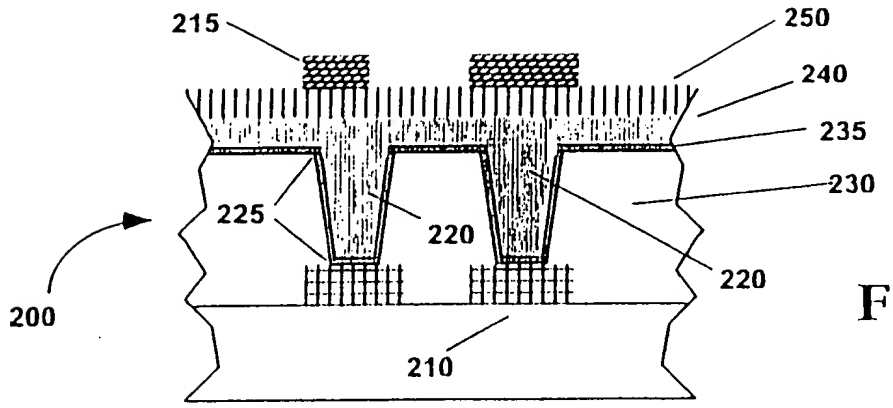


FIG. 2A

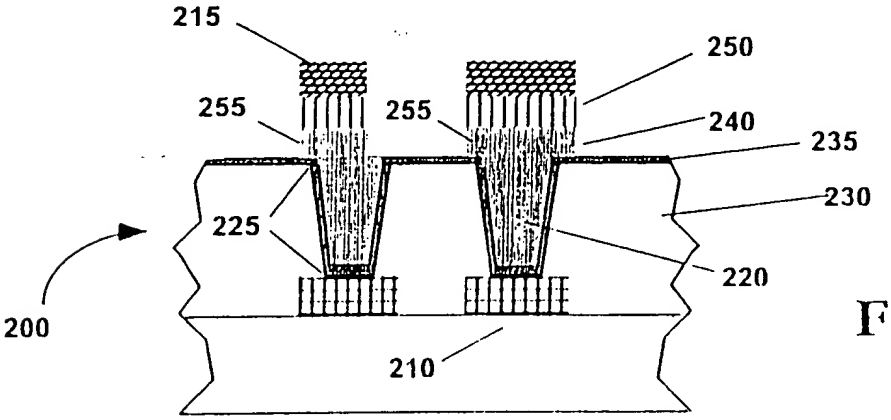


FIG. 2B

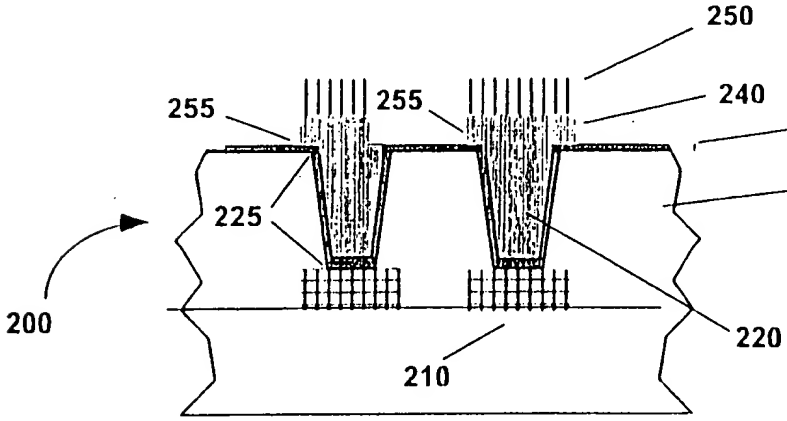


FIG. 2C

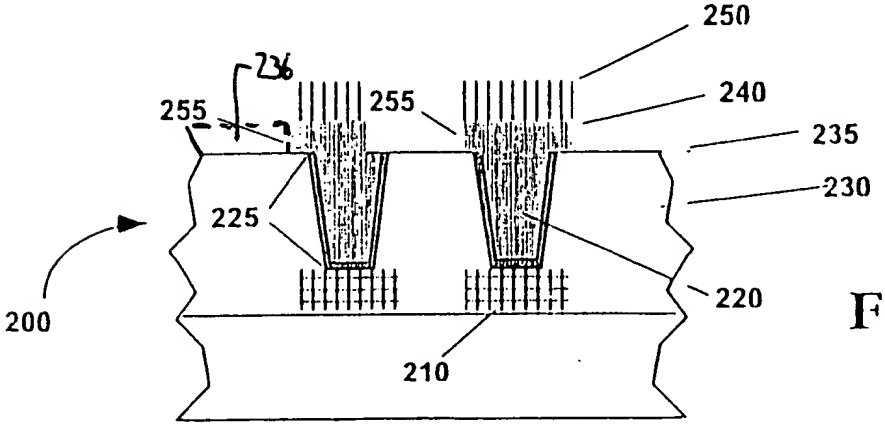


FIG. 2D